

## **Results of Surgical Treatment of Spinal Cord Tumors**

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**Introduction.** Recently, parametric criteria of standardized scoring have been used to evaluate the results of surgical treatment, which allows for a comparison of the treatment results reported by various authors in various groups of diseases. This also allows for a comparison of the patients' condition before and after surgery. For these purposes, scales for parametric scoring of the condition of spinal patients have been developed and are widely used. Using these scales, the condition of patients is assessed both before and after surgery, and the number of points is compared before treatment, immediately after surgery, and in the late period [1]. Extramedullary tumors of the cervical region are a special category of neoplasms of the central nervous system, which is associated predominantly with the benign nature of the process, but is distinguished by a critical location in an anatomical zone of high surgical risk [1, 2]. The location of space-occupying processes in the cervical region, near the neurovascular structures of the brainstem, and sometimes the direct involvement of these structures in the pathological process, has a fatal effect on both the early results of surgical intervention and the late functional consequences. Spinal cord tumors account for approximately 15% of all central nervous system tumors [1]. They are usually benign, and symptoms arise primarily from compression of the spinal cord and nerves [2]. Spinal cord tumors are divided into three groups: extradural, intradural-extramedullary, and intramedullary. Intramedullary spinal cord tumors (ISCTs) are less common, accounting for 2–5% of all spinal cord tumors [3,4]. They originate from the spinal cord tissue itself and lead to invasion and destruction of gray and white matter [5].

**Keywords:** spinal cord, tumor, laminectomy, Frankel, Mc-Cormick

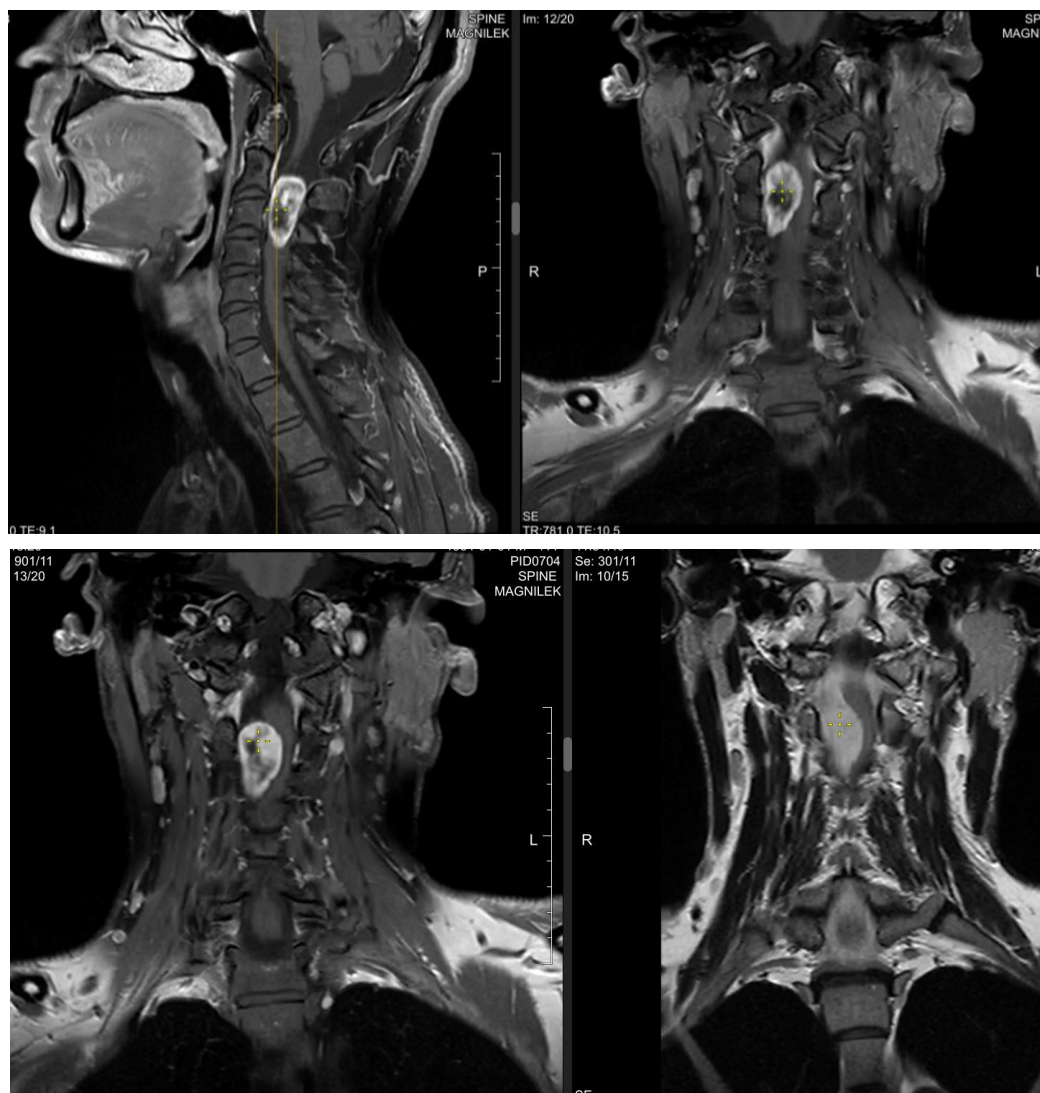
### **Clinical case**

The patient, a 27-year-old man, presented with complaints of gradually increasing neck pain radiating to both upper extremities, primarily on the right, as well as gradually developing arm weakness. Magnetic resonance imaging revealed a T2-hyperintense intradural extramedullary lesion at the level of the C3-C4 cervical vertebrae and the intervertebral disc, most likely consistent with a neurofibroma.

Physical examination revealed severe weakness in the upper extremities (MRC 2+) and decreased grip strength. No significant sensory disturbances were reported, with radiating pain being the primary symptom. The slow growth of the neurofibroma likely explains the gradual onset of symptoms and their moderate severity. Laminectomy is the primary surgical treatment

for spinal cord tumors. However, this procedure is not without serious complications, such as postoperative pain and delayed kyphosis. Hemilaminectomy is an alternative to laminectomy and has the advantage of preserving the posterior supporting structures of the spine on the contralateral side. In this study, we analyze the clinical outcomes of hemilaminectomy in terms of pain reduction and improvement in the Nurick score, as well as radiological data, assessing the development of delayed kyphosis. We also review the technique and operative features of hemilaminectomy for intramedullary and extramedullary spinal cord tumors. Intraoperative neuromonitoring was not used in any of the patients. After intubation, the patient was placed in the prone position. A small midline incision was made and deepened to dissect the muscles from the midline to expose the lamina of the vertebral arch on one side. Subperiosteal muscle dissection was performed carefully until the desired level of exposure was achieved. Ligaments and tendinous attachments of the muscles on the opposite side were left intact. The lamina of the arch at the selected level was removed using Kerrison rongeurs or a high-speed burr, depending on the surgeon's discretion. The ligamentum flavum was excised with Kerrison rongeurs to expose the dura mater. The dura mater was opened and secured in the open position with retention sutures. The arachnoid mater was then incised to expose the tumor. The tumor was biopsied in sections. Using an ultrasonic aspirator (CUSA Excel, Integra, Inc.), internal decompression of the tumor was performed, followed by complete removal. In cases of extraforaminal tumor extension, a complete or partial facetectomy was performed to visualize the extraforaminal portion and achieve complete removal. After tumor resection, the dura mater was sutured with 5.0 Prolene suture. Fibrin sealant (Tisseel™, Baxter Healthcare India) was used if necessary, at the surgeon's discretion.

Pic 1. Preoperative MRI. Subdural tumor of the spinal cord at the VC3-4-5 level, right side

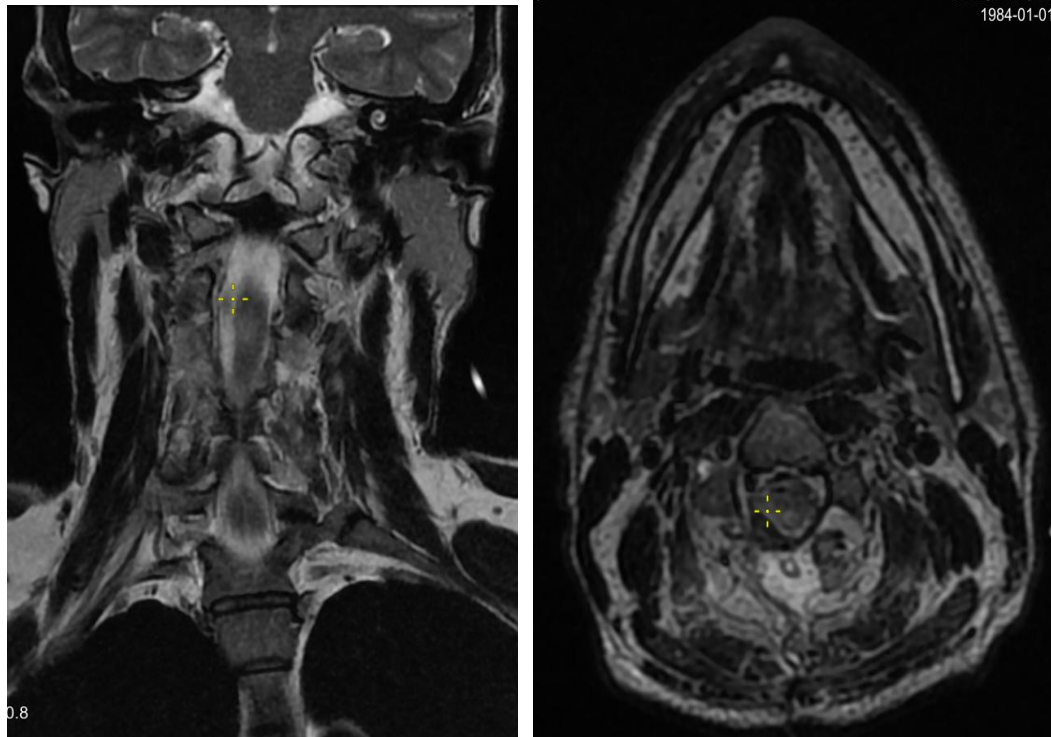


**Research results.** Although intradural spinal cord tumors are relatively rare, their diagnosis can be challenging and they often result in significant morbidity [6,7]. A definitive preoperative diagnosis is often impossible because many imaging findings overlap, but certain features may clearly suggest a specific disease. In this study, a variety of intradural spinal cord tumors were reviewed. The dentition was divided and the cord gently rotated when additional space was required. However, this was not necessary in all cases, as internal tumor decompression alone brought the remaining tumor into view, facilitating its complete removal. The dural attachment of the tumor was coagulated in all cases. This corresponded to a Simpson grade 2 resection, which showed comparably good recurrence rates and overall morbidity compared to grade 1 resection at long-term follow-up. [16] Alternative treatments for spinal meningiomas include dural incision and removal of the inner layer along with the tumor. [17] However, due to unfamiliarity with this technique and the risk of accidental rupture, which could lead to CSF leakage and increased morbidity, we did not employ this method. Despite our cautious approach, we did have one case of CSF leakage. This patient had a dorsolateral meningioma in which the dura mater was thinned and a small tear occurred during coagulation, which was sutured. However, this complication was managed conservatively.

The patient underwent five days of preoperative physical therapy to maintain muscle strength, after which complete surgical removal of the tumor was performed. Postoperatively, significant improvement was noted; pain was gone, with only mild weakness remaining. The patient was prescribed exercises to strengthen muscles and develop grip strength. Upon discharge, upper extremity strength was 4+ on the MRC scale.

Pic 2. Post-operation images





**Discussion.** Cervical spinal neurofibromas are among the most common spinal meningeal tumors. They are typically located intradurally and extramedullary and appear as hyperintense lesions on T2-weighted images. Clinical symptoms are caused by compression of the spinal cord or nerve roots. Early diagnosis and comprehensive treatment, including surgery and rehabilitation, ensure a good neurological prognosis. Pre- and post-operative physical therapy plays an important role in restoring motor function and preventing residual deficits. Unilateral Hemilaminectomy (UHL) is an alternative surgical technique for spinal cord tumors. This approach involves minimal muscle dissection and bone removal while preserving posterior ligamentous structures, which provides the additional benefit of maintaining spinal stability. There is a learning curve, but once mastered, surgeons can perform the procedure in a shorter time than with traditional methods. All these factors contribute to faster healing and hospital discharge, reducing the financial burden on patients.

**Conclusion.** This case highlights the importance of early MRI in cervical radiculopathy with motor impairments, as well as the need for a multidisciplinary approach combining surgical treatment and physical therapy to achieve optimal patient recovery. Based on these findings, appropriate preventive measures should be implemented at a young age to improve the planning, optimization, and monitoring of the patient's recovery after surgery.

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